

408
09/029977

WO 97/10293

PCT/EP96/04016

1/22

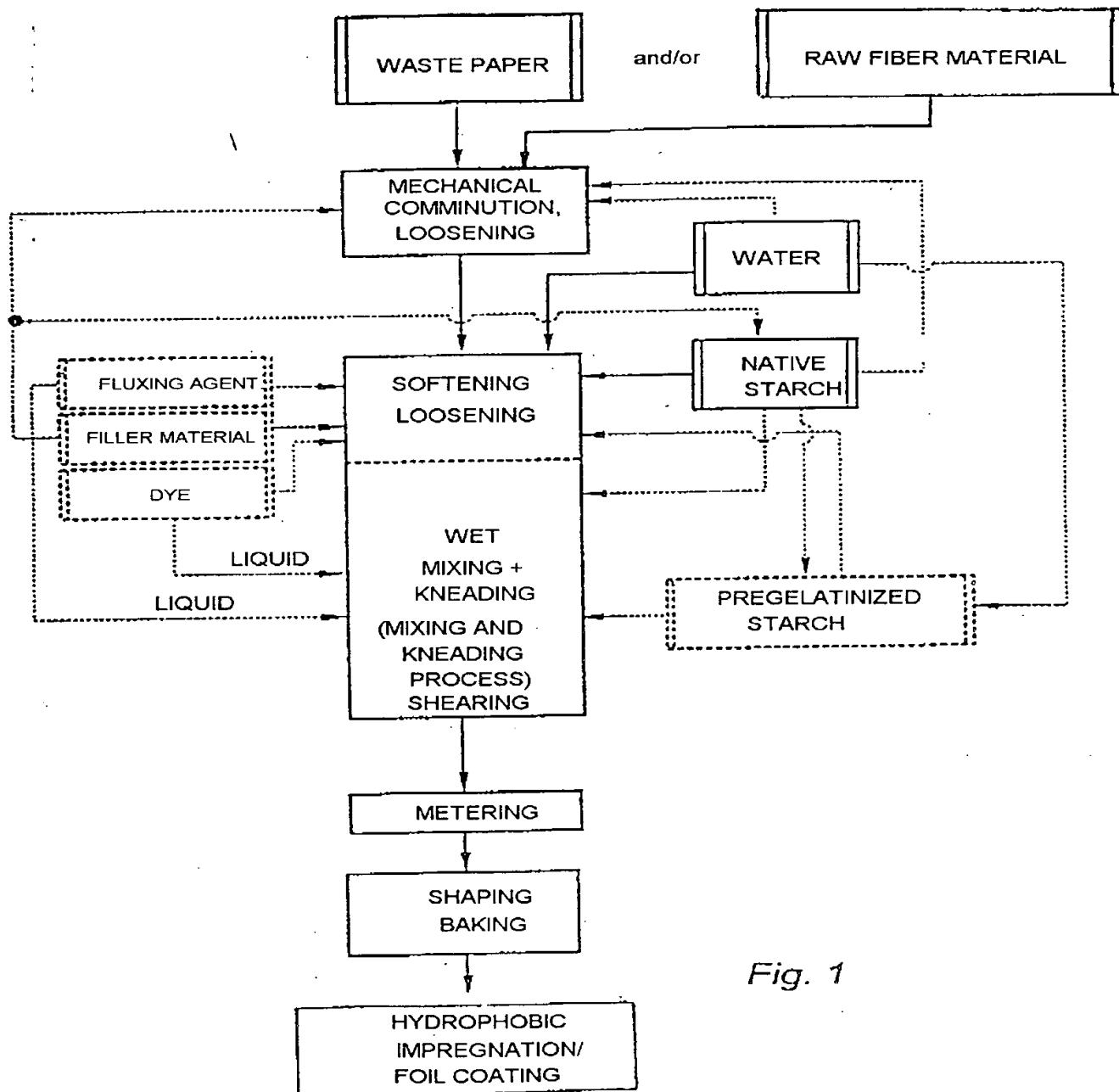


Fig. 1

2/22

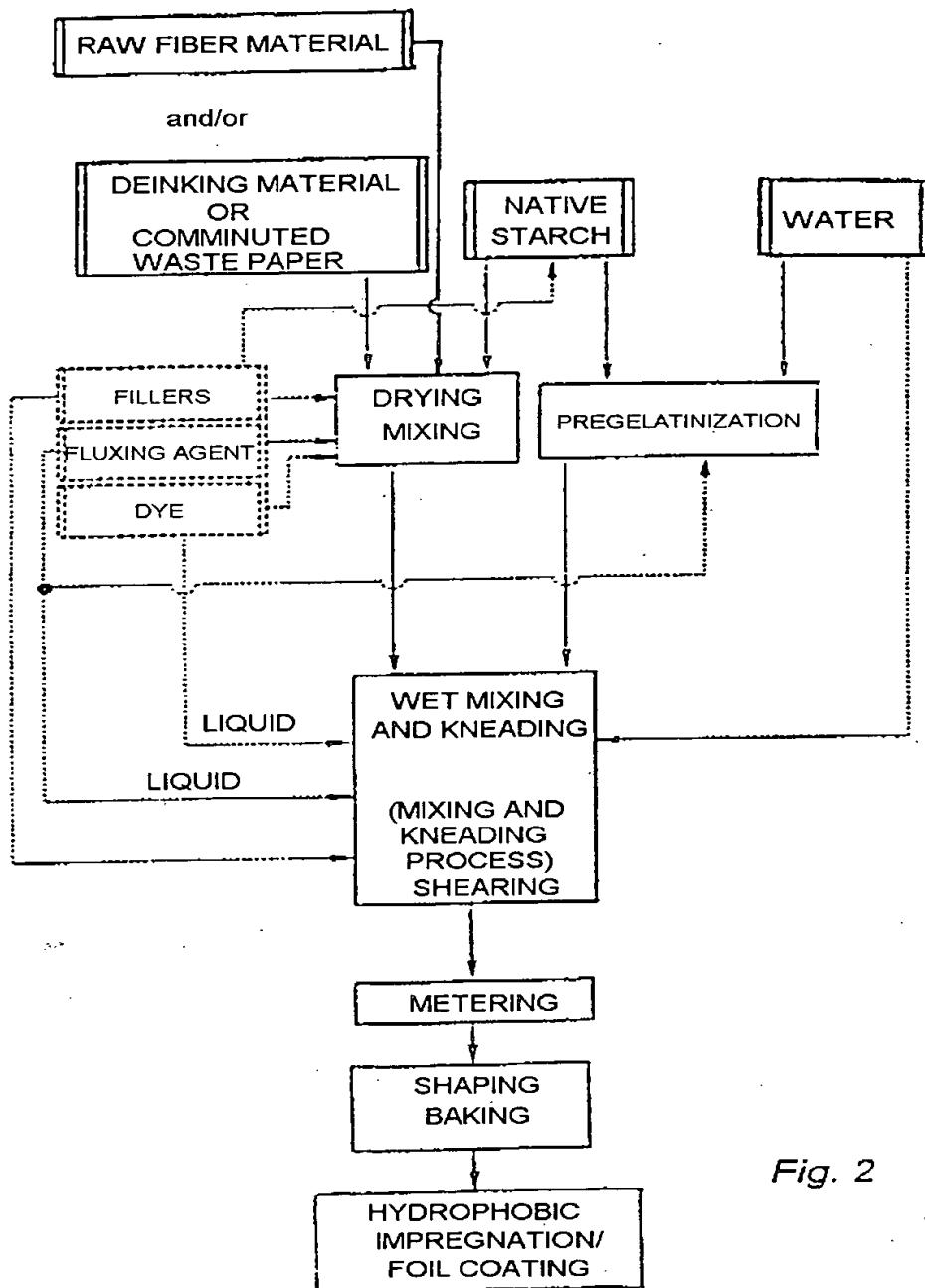


Fig. 2

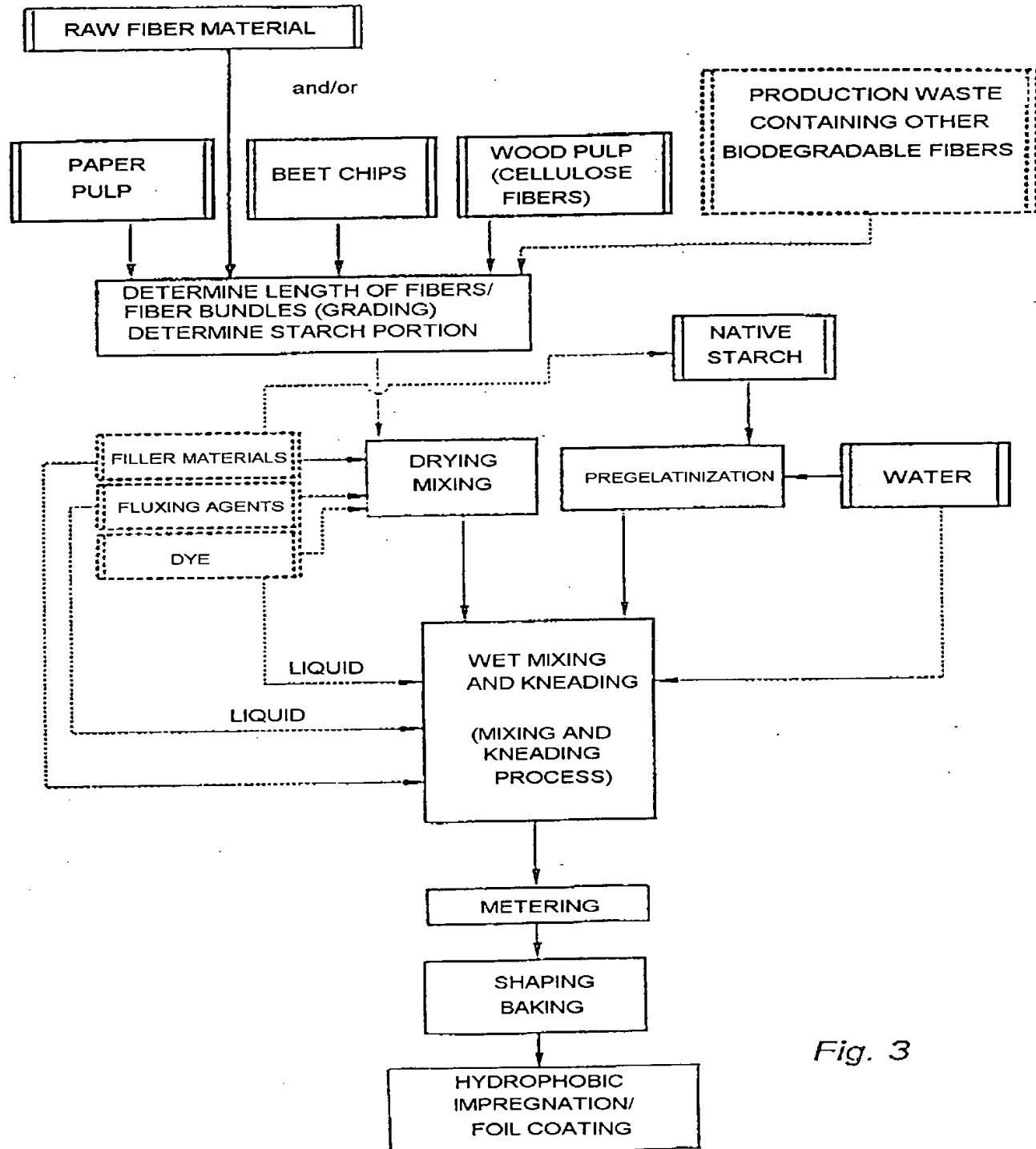


Fig. 3

4/22

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}
a	18,7	28,2	37,1	47	56,4	65,8	75	84,3	93,3	102,9	112,3	122	131,4	140,8	150

 x_{1-15} test sample

a in wt. % native starch

b = 250 wt. % water (in relation to dry mass
of fiber material)

c = 100 wt. % fiber material

Fig. 4a

native starch

probe/master	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}
1	25	84	111	131	150	169	168	206	225	244	281	281	300	150	75

a = native starch in percent by weight

b = 500 wt. % water in relation to fiber material (dry substance)

c = 100% fiber material

Fig. 4b

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
a	18,7	28,2	37,3	47	56,4	65,8	75	84,3	93,3	102,9	112,3	122	131,4	140,8	150
d	6,3	9,4	12,7	15,7	18,8	21,9	25	28,3	31,3	34,9	37,7	40,7	43,8	46,9	50
e	24,9	37,8	50	62,7	75,2	87,7	100	112,7	124,7	137,8	150	162,7	175,2	187,7	200

Fig. 5a

 X_{1-15} test sample

a in wt. % native starch

d in wt. % pregelatinized starch

e in wt. % total starch

b = 250 wt. % water (in relation to dry mass
of fiber material)

c = 100 wt. % fiber material

WO 97/10293

PCT/EP96/04016

7/22

ratios

test sample	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
6	23	94	113	131	150	169	168	206	225	244	263	281	300	319	350
1	75	31	38	44	50	58	63	68	75	81	86	94	100	100	100
6	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400

a = native starch in wt. %
d = pregelatinized starch in wt. %
e = total starch in wt. %
b = 500 wt. % water in relation to fiber material (dry substance)
c = 100% fiber material

Fig. 5b

09/029-977-408

WO 97/10293

PCT/EP96/04016

8/22

Grade	Long fibers/ fiber bundles [mm]
1	0.96 - 1.44
2	1.92 - 2.40
3	2.40 - 2.88
4	0.72 - 2.16
5	3.06 - 3.57
6	2.55 - 4.59
7	0.24 - 1.68
8	0.24 - 4.32

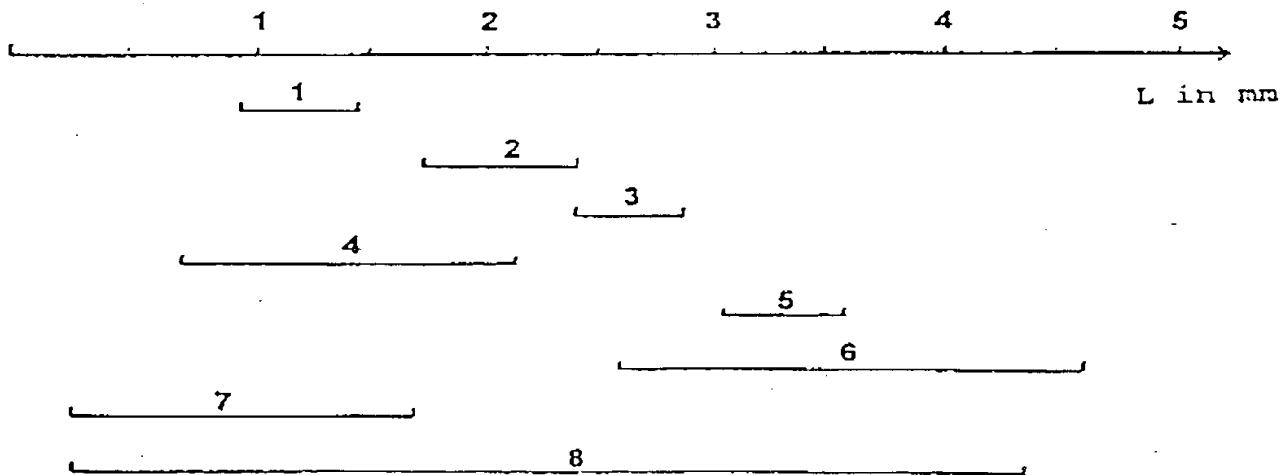


Fig. 6

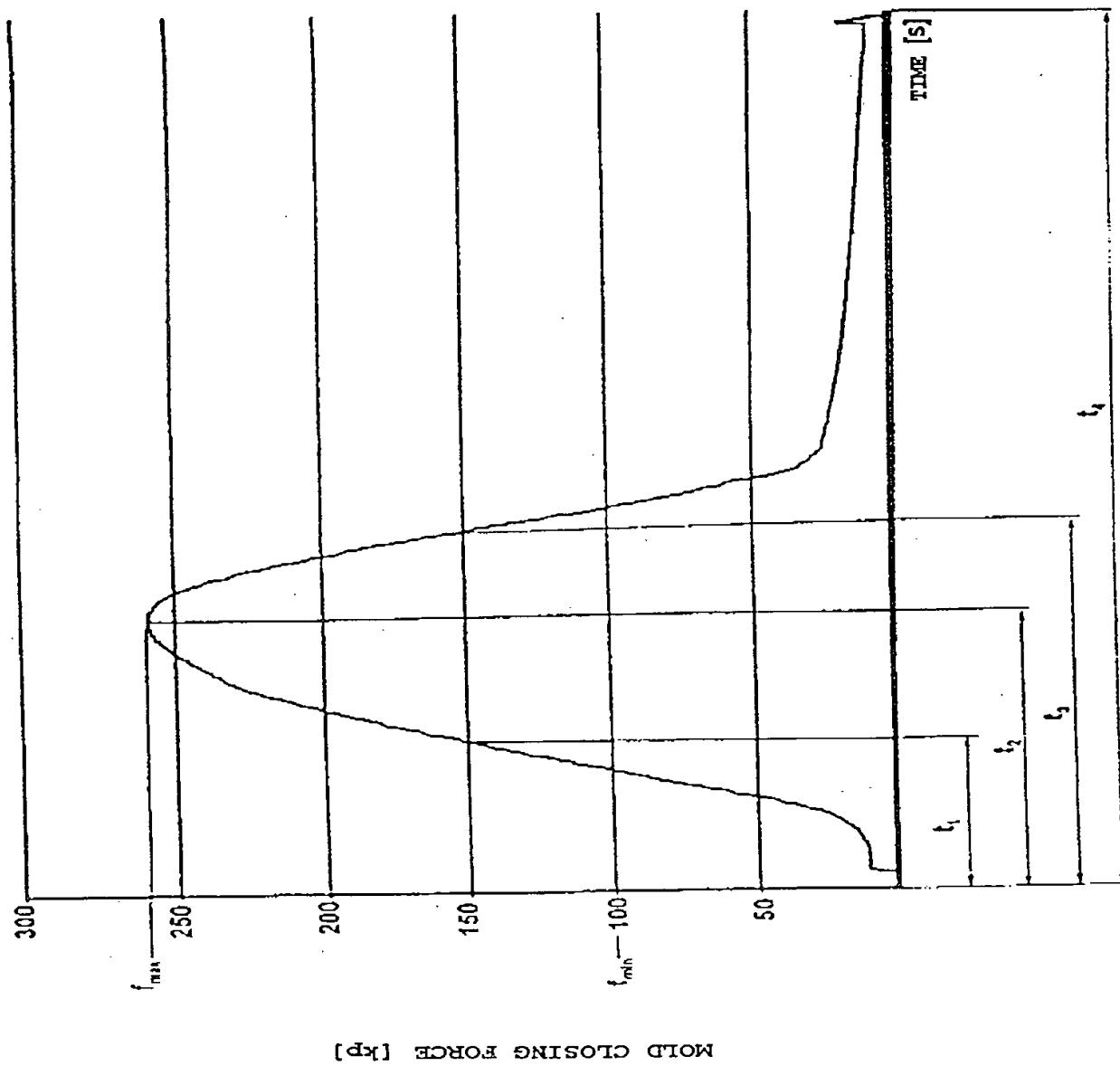
09/029977408

WO 97/10293

PCT/EP96/04016

9/22

Fig. 7



10/22

Use of fibers (fiber bundles) graded by fiber length according to Fig. 6

mold depth	~ 30 mm								~ 50 mm							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
fiber length	+	+	+	+	-	+	-	+	+	+	+	+	+	+	+	-
surface/ texture	-	-	+	-	+	+	+	-	-	-	-	-	-	-	-	-
strength/ stability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
elasticity/ structure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

mold depth	~ 80 mm								> 80 mm							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
fiber length	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
surface/ texture	-	-	+	-	+	+	+	-	-	-	-	-	-	-	-	-
strength/ stability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
elasticity/ structure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

+ molded body according to requirements

- molded body not according to requirements

Fig. 8

Use of fiber mixtures of different fiber length according to Fig. 6

mold depth	- 30 mm	- 50 mm	- 80 mm	> 80 mm
combination of fiber lengths according to Fig. 6	7 + 4 4 + 2 7 + 2 + 3 4 + 2 + 3 8	7 + 2 + 3 + 5 8	7 + 2 + 3 + 5 8	7 + 2 + 6 8 + 6
surface/ texture	- + - + +	+ + +	+ + +	- - +
strength/ stability	+	+	+	+
elasticity/ structure	- + +	+ + +	+ + +	+
fiber material/starch	60 : 40	55 : 45	50 : 50	45 : 55
starch/water	0,4 : 1	0,4 : 1	0,4 : 1	0,3 : 1

+ molded body according to requirements

- molded body not according to requirements

Fig. 9

09/029 977 401

WO 97/10293

PCT/EP96/04016

12/22

in wt. %	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}
fiber material to total mass	26,7	25,8	25	24,2	23,5	22,8	22,2	21,6	21,1	20,5	20	19,5	19	10,6	18,2
total starch to total mass	6,6	9,7	12,5	15,2	17,7	20,1	22,2	24,3	26,2	29,2	30	31,7	33,4	34,9	16,1
water to total mass	66,7	64,5	62,5	60,6	59,8	57,1	55,6	54,1	52,7	51,1	50	48,8	47,6	46,5	45,5
pregelatinized starch to total mass	1,6	2,4	1,2	1,8	4,4	5	5,5	6,1	6,6	7,1	7,5	7,9	8,4	8,7	9

 x_{1-15} test sample

Fig. 10

Percent by weight in mass

in wt. %	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}
fiber/mass	14.3	13.8	13.3	12.9	12.5	12.1	11.8	11.4	11.1	10.8	10.5	10.3	10.0	11.8	12.9
total starch/mass	14.3	17.2	20.0	22.6	25.0	27.3	29.4	31.4	33.3	35.1	36.0	38.5	40.0	28.4	22.6
pregel. starch/mass	10.7	4.3	5.0	5.6	6.1	6.9	7.4	7.8	8.3	8.6	9.2	9.6	10.0	11.0	12.9
water/mass	71.4	69.0	66.7	64.5	62.5	60.8	58.8	57.1	55.8	54.1	52.8	51.3	50.0	58.8	61.5

 y_{15} = test sample

Fig. 11

14/22

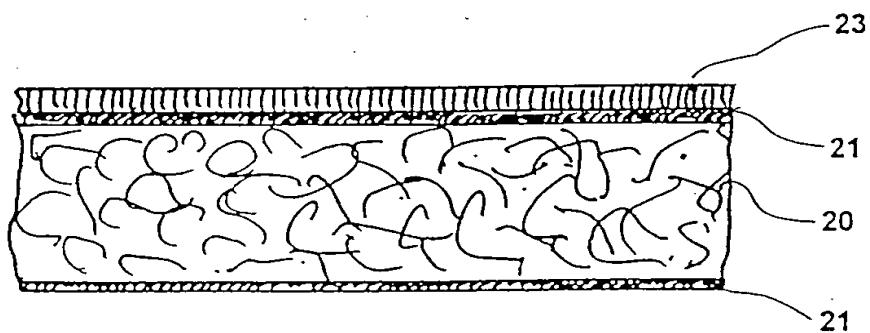


Fig. 12

Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions Ø 125 mm, vol. 500 ml, height 76 mm

Recipe: Y14

Coating: cellulose acetate (CA)

TS: 4.5% - 15 wt. % dry substance in spray solution

η: 20 - 4000 mPas (viscosity)

Application: spraying, casting, dipping

Layers: 1 - 3 (quantity)

Solvent: acetone

Shape	Thick- ness	Coating	Method	Resistance		
				water 100°C	oil (cold)	water (cold)
				1h	3 days	3 days
pot	89 µm	3.8 g	casting	+	+	+
tray	79 µm	2.3 g	casting	+	+	+
pot	65 µm	2.8 g	spraying	+	+	+
tray	68 µm	2.0 g	spraying	+	+	+
tray	58 µm	1.7 g	spraying	+	+	+
pot	34 µm	1.5 g	spraying	-	-	-
tray	27 µm	0.8 g	spraying	-	-	-

Fig. 13

Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions Ø 125 mm, vol. 500 ml, height 76 mm

Recipe: Y14

Coating: cellulose acetate propionate(CAP)

TS: 9% - 20 wt. % dry substance in spray solution

 η : 200 - 6000 mPas (viscosity)

Application: spraying, casting, dipping

Layers: 1 - 3 (quantity)

Solvent: acetone

Shape	Thickness	Method	Resistance		
			water 100°C 1h	oil cold 3 days	water cold 3 days
pot	88 μ m	casting	+	+	+
tray	88 μ m	casting	+	+	+
pot	58 μ m	spraying	+	+	+
tray	70 μ m	spraying	+	+	+
tray	56 μ m	spraying	+	+	+
pot	33 μ m	spraying	-	-	-
tray	22 μ m	spraying	-	-	-

Fig. 14

17/22

Trays dimensions 112 x 200 x 17.5 mm

Pots dimensions Ø 125 mm, vol. 500 ml, height 76 mm

No.	Foil	Thick-ness	Deep-drawing quality in tray	Deep-drawing quality in tray	Resistance		
					water 100°C	oil cold	water cold
1	poly-ester amide	100 µm	+	-	-	+	+
		150 µm	+	-	—	+	+
2	poly-ester	70 µm	+	-	—	+	+
3	poly-lactic acid (rigid)	50 µm	-	-	-	+	+
		100 µm	-	-	-	+	+
4	poly-lactic acid (elast.)	50 µm	+	-	+	+	+
		100 µm	+	+	+	+	+

Foil Melting point

1 approx. 120°C

2 approx. 85°C

3 approx. 115°C

4 approx. 130°C

Fig. 15

Cellulose acetate / Cellulose acetate propionate

Softener 10-30 wt.%					without softener
Diethyl- phthalate		Triacetin	Tributyl citrate	Acetyl tributyl citrate	
CA	V+/H+	V+/H+	V-/H-	V-/H-	H O
CAP	V+/H+	V+/H+	V+/H+	V+/H+	H +

Key: + = good O = medium - = poor
 V = compatibility H = adhesion

Fig. 16

09/029977401

WO 97/10293

PCT/EP96/04016

19/22

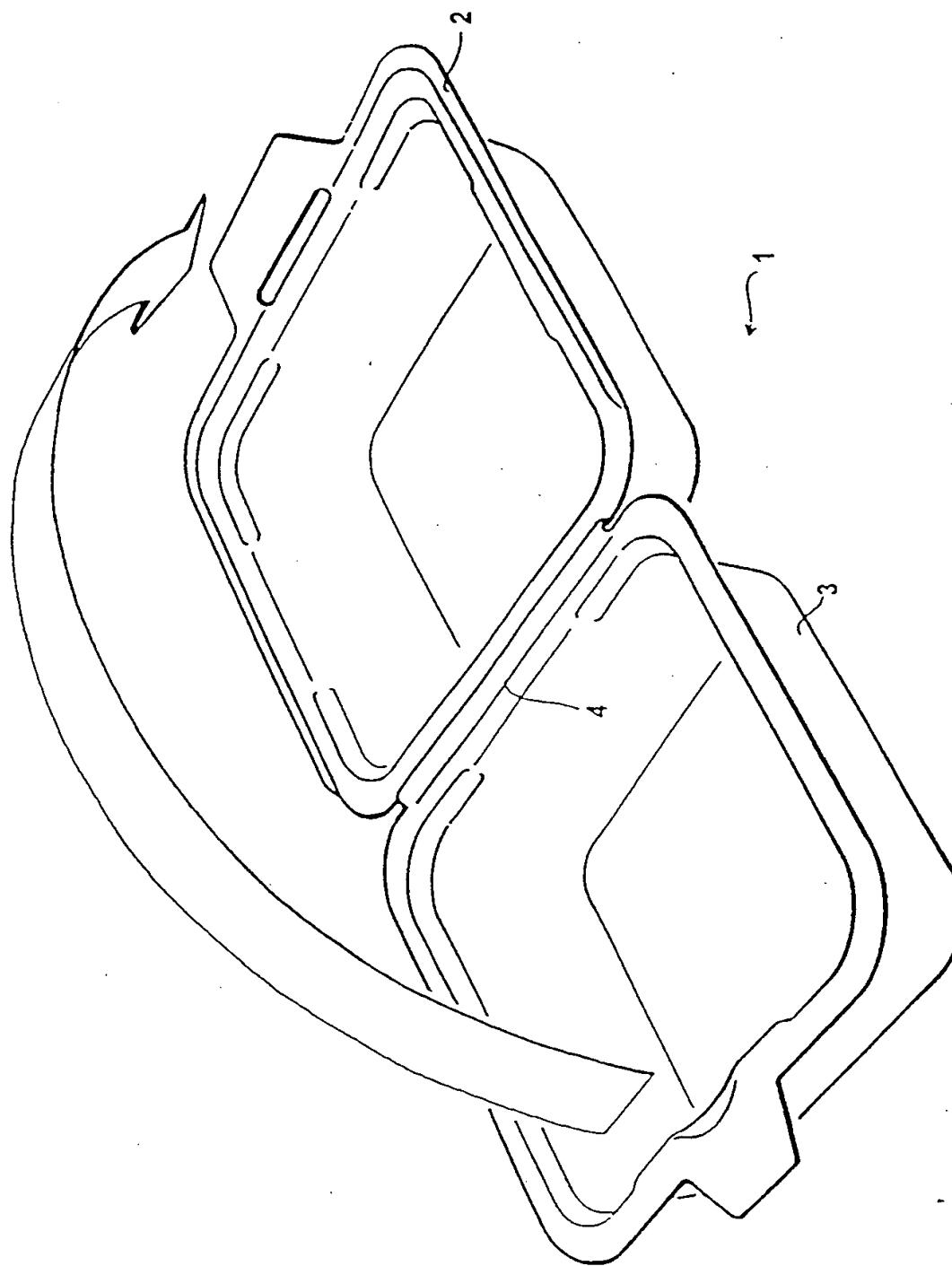


Fig. 17

09/029977 408

WO 97/10293

PCT/EP96/04016

20/22

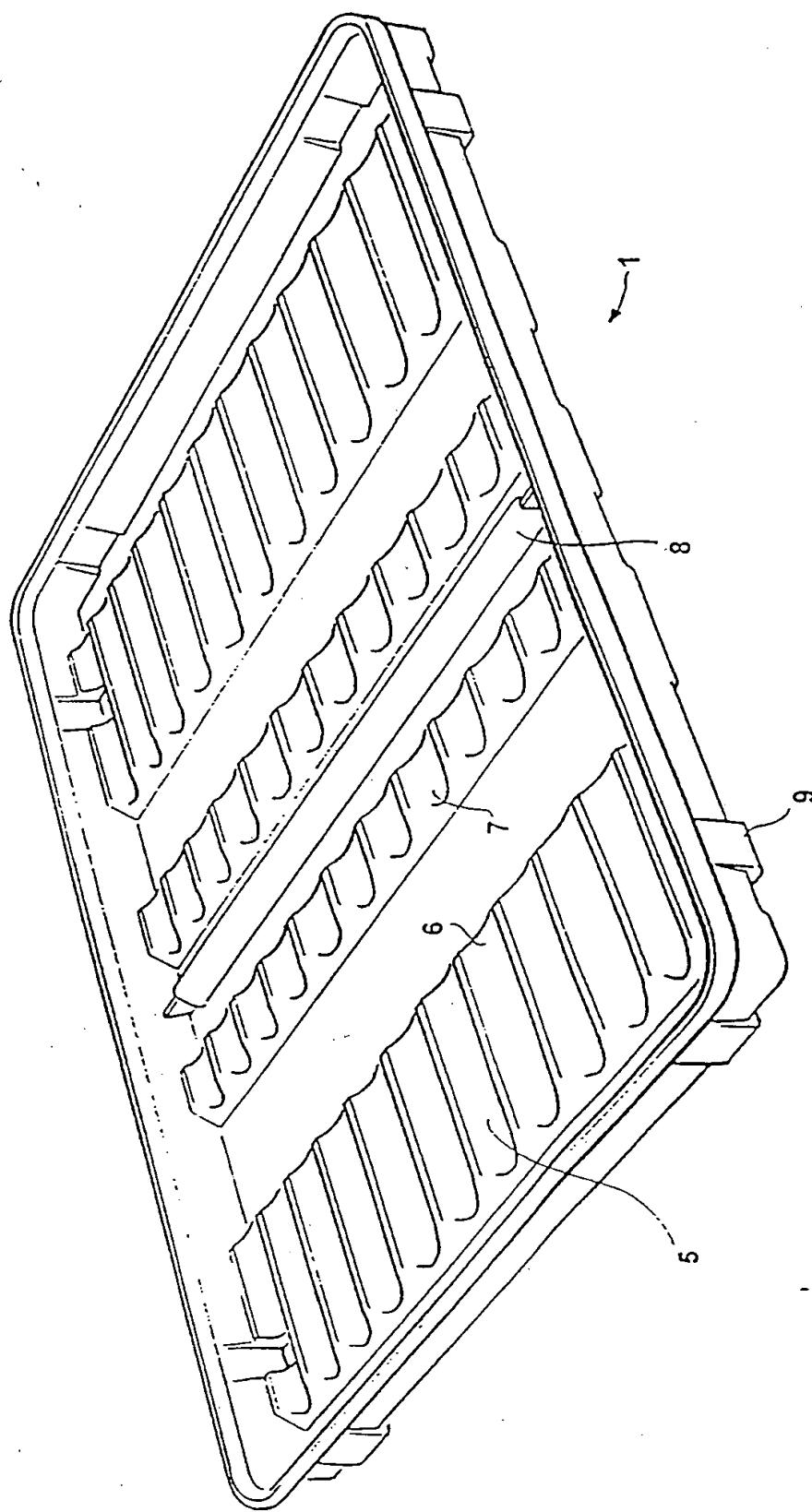


Fig. 18

09/029977401

WO 97/10293

PCT/EP96/04016

21/22

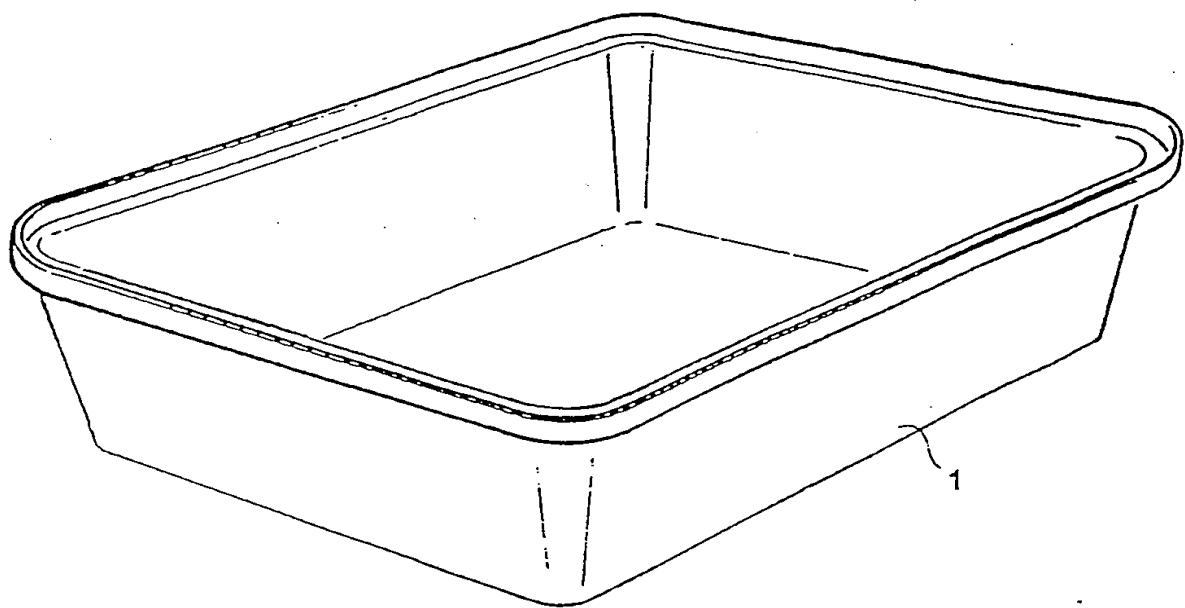


Fig. 19

09/02997740r

PCT/EP96/04016

WO 97/10293

22/22

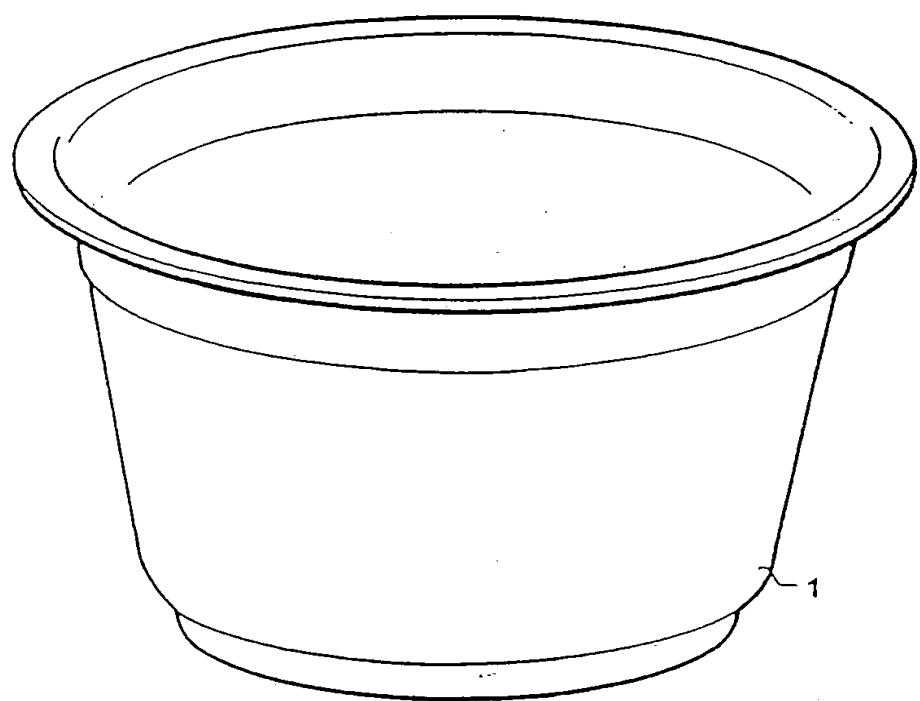


Fig. 20